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NICOLAS RUWET

## METHODS OF ANALYSIS IN MUSICOLOGY

*translated and introduced by Mark Everist*

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### INTRODUCTION

Nicolas Ruwet's 'Methods' deserve a broader reception than they have so far been afforded. When they appeared in 1966, they represented the first coherent attempt to articulate a music-analytical system which drew on the distributional and taxonomic procedures of anthropology, linguistics and ethnomusicology; they also form a large part of a system which has generated much critical comment, especially in the French and French-Canadian musico-semiotic worlds,<sup>1</sup> in its twenty years' existence; furthermore, they constitute one of the few sets of analytical methodologies which initially address repertoires other than those of the 'common practice' era. The concentration in 'Methods' on monodies from the twelfth to the fourteenth centuries makes their exclusion from contemporary discussions of the 'analysis of early music', with its all-too-often duplicative obsession with voice-leading procedures,<sup>2</sup> all the more regrettable.

Ruwet himself admits to two types of influence in the evolution of his methods: the mostly oral teaching of André Souris and Pierre Froidebise,<sup>3</sup> and the less intangible, better known, work of Gilbert Rouget, Roman Jakobson and Claude Lévi-Strauss.<sup>4</sup> The relationship between the work of these authors and Ruwet's was discussed in detail by Jean-Jacques Nattiez in 1975 as a preamble to his systematic overhaul of Ruwet's 'Methods' in *Fondements d'une sémiologie de la musique*.<sup>5</sup>

The most significant response to the original (1966) publication of Ruwet's 'Methods' was, however, from the ethnomusicologist Simha Arom, whose 1969<sup>6</sup> article concentrated initially on Ruwet's notation but went on to discuss alternative views of the segmentation of the first piece discussed by Ruwet, the fourteenth-century *Geisslerlied*. Whether Arom's rectilinear analyses are clearer or more productive than Ruwet's paradigmatic presentations still seems to be an area for further inquiry, although there seems little doubt that such explanations as those offered, for example, by Ruwet's Ex. 1d are handled with

\* For notes to the introduction, see page 7 below.

much greater finesse in rectilinear analysis. Arom's conclusions coincided with the view of Jean Molino, so influential on Nattiez's *Fondements*, that 'Ruwet's procedures do not supply a key, but a *bunch* of keys, that is to say a set of analytical *possibilities* . . .',<sup>7</sup> and played an important role in Nattiez's discussion of Ruwet's hierarchic structures.

At the end of the first paragraph of his *Geisslerlied* analysis, Ruwet states that 'clearly, it would be very difficult to apply the procedure to the presentation of polyphonic structures'.<sup>8</sup> This provoked one of the few examples of a strict attempt to apply Ruwet's methods to a repertory which he had already acknowledged as problematic: Jean-Michel Vaccaro, leaning on both Ruwet's 'Methods' and his contribution to the function of text in vocal music,<sup>9</sup> produced in 1975 an analysis of the polyphonic *chanson* by Guillaume Costeley to a text by Ronsard: *Mignonne allon voir*.<sup>10</sup> This is not the occasion to discuss the relationship of Vaccaro's 'Proposition' to Ruwet's 'Methods', except to note the silence which has greeted these endeavours from those who seek to explain the musical processes of the sixteenth-century *chanson* and of Renaissance music in general.

In the same year as the appearance of Vaccaro's 'Proposition', David Lidov contributed two studies to the theoretical tradition created by 'Methods', one which reviewed and revised the analytical system, particularly with regard to Ruwet's interpretation of *Kalenda maya* and Guiot de Provins' *Molt me mervoilt*,<sup>11</sup> and another which furthered the discussion with another medieval monody, by Li Tresoriers de Lille (Pieros li Borgnes): *Haut honor d'un commandement*.<sup>12</sup> Here, perhaps even more than in Ruwet's analyses, the technical problems posed by the original notation take on greater significance; they are particularly pressing, for example, in Lidov's account of rhythmic figures.<sup>13</sup> This, along with the relevant Ruwet analyses, points to the urgent need for a review of the texts of these analyses as much as their methodology.<sup>14</sup>

It would be wrong to suggest that music before 1600 has had a monopoly of subsequent discussions of 'Methods'. Gilles Naud's studies of Xenakis' *Nomos Alpha*<sup>15</sup> not only parallel Nattiez's study of Varèse's *Densité 21.5* but also take Xenakis' own comments on musical segmentation as a starting point for the analysis. Whilst Naud eschews Ruwet's paradigmatic display of the musical data, the analysis of *Nomos Alpha* opens up fascinating lines of inquiry which depend directly on 'Methods'.

Almost contemporary with the work of Lidov and Vaccaro was a series of analyses of secular music by Machaut, designed to demonstrate 'pitch patterning of a quasi-ostinato character', which were produced by Lawrence Gushee in September 1974.<sup>16</sup> The sceptical response to these analyses prompted a further contribution from Gushee in 1975<sup>17</sup> which included a series of 'paradigmatic diagrams' of some monophonic *chansons* of Adam de la Halle and monophonic dance music. These were subsequently published in 1982.<sup>18</sup> Given the obvious distributional nature of Gushee's analyses, it is curious that the work of Ruwet, and the large body of literature which had been thus engendered by 1982, was consigned to a single sentence:

One should refer to the recent (*sic*) application of the technique by Nicholas Ruwet to a 14th-century *Geisslerlied*, ultimately disastrous due to the author's *ignorance* of the documentary evidence (emphasis added).<sup>19</sup>

Gushee does not explain Ruwet's 'ignorance', but he is probably responding to Ruwet's statement: 'Since I am not interested here in problems of transcription, I take the transcriptions as data, without prejudging their validity'.<sup>20</sup> This seems strange in view of Gushee's self-confessed original use of Wilkins' edition of Adam de la Halle's *chansons*.<sup>21</sup> Unlike Gushee, however, Ruwet is not primarily concerned with the elucidation of a single song, be it by a *troubadour*, *trouvère* or flagellant, but with analytical method (hence his title). Nevertheless, there are indeed problems with the texts that Ruwet selects for his analyses, problems which centre on the question of the rhythmic evaluation of thirteenth- and early fourteenth-century notation. The influence on Ruwet of Friedrich Gennrich and Gustave Reese reflects the latter's view of the rhythmic structure of medieval song; in all cases except the *Geisslerlied*,<sup>22</sup> this involves the assumption that the application of the principles of modal rhythm is appropriate to this repertory. There have been many challenges to this assumption,<sup>23</sup> although there is still a great reluctance to overthrow the modal orthodoxy. The result of this schismatic view of the rhythm of *trouvère* and *troubadour* song is that analyses of this music which use editions employing modal rhythm are likely to be condemned for inaccuracy. In the specific cases discussed in 'Methods', the issue is further complicated by the fact that, in Ruwet's stage (b)<sup>24</sup> of his analytical procedure, the total duration of each segment is taken as an index for the further segmentation of level I units. However, it is unconstructive simply to dismiss an analytical methodology out of hand on these grounds alone. The assessment of the degree of variation between, on the one hand, an analysis based on a 'free declamatory' edition of the song and, on the other hand, Ruwet's original analysis would make a valuable contribution to the development of the analysis of medieval song.

More significantly, perhaps, Gushee exaggerates his response to Ruwet's dependence on the philosophies of Popper and Hayek. Gushee writes:

A strictly applied paradigmatic technique rests on concepts of identity or similarity with respect to pitch letter name patterns . . . . It is a technique for segmentation, replacing other criteria – cadences, proportions, text structure – with that of pitch recurrences, and pretends to isolate minimal formal elements.<sup>25</sup>

The idea that Ruwet's paradigmatic technique *replaces* other criteria with 'pitch letter name patterns' seems extreme, and adjusting 'replacing' to 'complementing' might be more accurate. More important, however, is the concentration on the apparent 'strictness' of this 'paradigmatic technique'. Ruwet himself says (in 1966), referring to and quoting Zellig Harris *in extenso*, that 'the procedure is much more one of verification, meant to ensure that the

analysis is coherent, than a discovery procedure in the strict sense of the term'.<sup>26</sup>

Nattiez's discussion of Ruwet's 'Methods' and their accretions, in *Fondements*, was the most comprehensive to date.<sup>27</sup> Synthesising the distributional ideas of Ruwet and Arom with Jean Molino's concept of tripartition, Nattiez gave a revised form of Ruwet's 'Methods' pride of place in his 'neutral level' and generated analytical examples which have served as models for subsequent inquiry.<sup>28</sup> The relationship between Ruwet's 'Methods' and Nattiez's *Fondements* is obscured by the former's recantation in *Musique en jeu*.<sup>29</sup> If the work of Nattiez, Lidov and others provided the stimulus for his retraction, a more deep-seated explanation was given by Ruwet himself:

For myself, I have serious doubts concerning the validity and interest of inductive procedures; I would adopt a more rationalist and more 'theoretical' procedure; I believe in the possibility and the necessity of the research of universals. I distrust relativism and behaviourism, etc. There is certainly no question here of offering another critique of empiricism and of positivism. Others have done it, better than I could ever do. I shall refer only to the classic texts on the question . . .<sup>30</sup>

Ruwet's 'classic texts' are Noam Chomsky's theoretical monographs on generative grammar<sup>31</sup> and the more popular works of Karl Popper and Friedrich Hayek.<sup>32</sup> More specifically, for Ruwet:

A more serious reading of Popper has convinced me that the ideal of the *tabula rasa* is illusory and that, no matter what we do, as soon as we reflect on any subject, we always approach it with preconceived theories.<sup>33</sup>

The question of the significance of positivism and empiricism in Ruwet's 'Methods' and in Nattiez's use of them strikes a chord with Gushee's apparent criticism of Ruwet's 'Methods' as a 'strictly applied paradigmatic technique'. Ruwet's critique of his original (1966) ideas is puzzling. It astonished Nattiez, who asked if 'Ruwet has not substituted for a reading of [an earlier version of this part of *Fondements*] the sometimes rapid criticisms aimed by Chomsky and his disciples at the taxonomic perspective'.<sup>34</sup> Nattiez continued, paradoxically making the same point as had Ruwet in 'Methods':

*It is absolutely wrong to pretend that the classificatory procedure [la démarche classificatoire] . . . appeals neither to intuitions nor to hypotheses* (Nattiez's emphasis).<sup>35</sup>

Whatever the confusions surrounding Ruwet's retraction, there is no doubt that his 'Methods' of 1966, albeit in the guise of Nattiez's neutral level, and not Ruwet's 'Théorie et méthodes' of 1975 have had the more lasting influence. Both are discussed with relative impartiality in more detail in Reinhard Schneider's review in *Semiotik der Musik*<sup>36</sup> of Ruwet's contribution to music

semiotics, although the difference between the reception of 'Methods' and 'Théorie et méthodes' is perhaps underplayed.

There will be many objections to the viewpoint proposed in 'Methods'. Certainly the emphasis on modal categorisation misses its target. But it is equally true that many of the suggestions explicitly offered by Ruwet (the investigation of parametric/non-parametric elements) and Vaccaro (the application of this approach to other repertoires), as well as those which have so far only been hinted at (comparative studies and the theoretical evaluation of empiricism and pragmatism in the context of this analytical method) have yet to be taken up.<sup>37</sup>

Devotees of voice-leading procedures have held the high ground in the analysis of 'early' music for too long at the expense of other, at least equally productive, lines of analytical inquiry. Ruwet's 'Methods' should already be familiar to any semiotician of music; they should also be given a much greater exposure in the analysis of music composed before 1600.<sup>38</sup>

## NOTES TO THE INTRODUCTION

1. Ian Bent offered the most sympathetic treatment of Ruwet's 'Methods' in 'Analysis, III, 7: Distribution', *The New Grove Dictionary of Music and Musicians*, ed. Stanley Sadie (London: Macmillan, 1980), Vol. 1, pp.377-8, where he summarised Ruwet's analysis of Guiot de Provins' *Molt me mervoil*.
2. Perhaps the best articulation of this point of view was given by Saul Novack, 'The Analysis of Pre-Baroque Music', *Aspects of Schenkerian Theory*, ed. David Beach (New Haven: Yale University, 1983), p.133: 'We have no other recourse for understanding the music of the past but to rely upon what Schenker has taught us. Its validity is unquestionable; its limitations, none'. Whilst the context of Novack's article would seem to preclude any discussion of techniques not associated with voice leading, such unquestioning acknowledgement of the primacy of these procedures should not go unchallenged.
3. Both Souris and Froidebise held positions respectively at the conservatoires in Brussels and Liège. With the exception of the encyclopaedia articles cited by Ruwet in the footnotes of 'Methods', none of Souris' voluminous publications assist in tracing the influences on Ruwet's thinking.
4. See p.11 and note 4.
5. Jean-Jacques Nattiez, *Fondements d'une sémiologie de la musique*, Série Esthétique (Paris: Union Générale d'Éditions, 10/18, 1975), pp.240-4.
6. Simha Arom, 'Essai d'une notation des monodies à e fins d'analyse', *Revue de musicologie*, Vol. 55, 1969, pp.172-216.
7. Nattiez, *Fondements*, p.254.
8. See below, p.20.
9. Nicolas Ruwet, 'Fonction de la parole dans la musique vocale', *Revue belge de musicologie*, Vol. 15, 1961, pp.8-28; reprinted in *Langage, musique, poésie*, Collection poétique (Paris: Seuil, 1972), pp.41-69.



10. Jean-Michel Vaccaro, 'Proposition d'un analyse pour une polyphonie vocale du xvie siècle', *Revue de musicologie*, Vol. 61, 1975, pp.35-58.
11. David Lidov, 'Musical Phrase Structure in the Theories of Riemann, Cooper and Meyer, and Ruwet', *On Musical Phrase* (Montreal: University of Montreal [Internal Publication], 1975), pp.35-77.
12. Lidov, 'Syntactical Strata in Music', *ibid.*, pp.79-85.
13. As is the case with Ruwet's *Geisslerlied* analysis, Lidov depends on the transcription in Gustave Reese, *Music in the Middle Ages* (New York: Norton, 1940), pp.228-9, in his analysis of *Haut honor d'un commandement*. The rhythmic transcription given there is only one of a number of possible versions of the notation given in MS Paris, Bibliothèque de l'Arsenal 5198, p.232.
14. See below, pp.4-5.
15. Gilles Naud, 'Pour une méthode d'analyse du niveau neutre en sémiologie musicale', 2 vols (Thèse de Maîtrise, University of Montreal, 1974); 'Aperçus d'une analyse sémiologique de *Nomos Alpha*', *Musique en jeu*, Vol. 17, 1975, pp.63-72.
16. Lawrence Gushee, 'Two Central Places: Paris and the French Court in the Early Fourteenth Century', paper read at Symposium "'Peripherie und Zentrum" in der Geschichte der ein- und mehrstimmigen Musik des 12. bis 14. Jahrhunderts', Berlin, September 1974; published in *Gesellschaft für Musikforschung: Bericht über den internationalen musikwissenschaftlichen Kongress Berlin 1974*, ed. Hellmut Kühn and Peter Nitsche (Kassel: Bärenreiter, 1980), pp.147-8; see also the discussion on pp.153-7.
17. Lawrence Gushee, 'Analytical Method and Compositional Process in some Thirteenth and Fourteenth-Century Music', paper read at symposium 'Aktuelle Fragen der musikbezogenen Mittelalterforschung', Basle, 1975; published in *Aktuelle Fragen der musikbezogenen Mittelalterforschung: Text zu einem Basler Kolloquium des Jahres 1975*, Forum musicologicum: Basler Beiträge zur Musikgeschichte 3 (Basle: Amadeus, 1982), pp.165-91.
18. See above, note 17.
19. Gushee, 'Analytical Method', p.171.
20. See below, p.20 and note 23.
21. Nigel Wilkins, ed., *The Lyric Works of Adam de la Halle*, *Corpus mensurabilis musicae* 44 (n.p.: American Institute of Musicology, 1967); see also Gushee, 'Analytical Method', p.169.
22. Runge's edition of this piece (see below, note 23) is a compromise between diplomatic facsimile and edition with equivocal indications of rhythm; the rhythmic transcription used by Ruwet is the responsibility of Reese.
23. The best review of this question and summary of the challenges to the assumptions of modal rhythm is in Hendrik van der Werf, review of Hans Tischler and Samuel Rosenberg, eds, *Chanter m'estuet: Songs of the Trouvères* (London: Faber and Faber, 1981), in *Journal of the American Musicological Society*, Vol. 35, 1982, pp.539-54.
24. See below, p.18.
25. Gushee, 'Analytical Method', p.172.
26. See below, p.20.

27. Nattiez, *Fondements*, pp.239-78.
28. Ibid., pp.297-356.
29. Nicolas Ruwet, 'Théorie et méthodes dans les études musicales: quelques remarques rétrospectives et préliminaires', *Musique en jeu*, Vol. 17, 1975, pp.11-36.
30. Ibid., p.12.
31. Noam Chomsky, *Syntactic Structures*, Janua linguarum: studia memoriae Nicolai van Wijk dedicata 4 (The Hague: Mouton, 1957); *Aspects of the Theory of Syntax* (Cambridge, Mass.: MIT Press, 1965); *Language and the Mind* (New York: Harcourt and Brace, 1968); *Studies on Semantics and Generative Grammar*, Janua Linguarum: studia memoriae Nicolai van Wijk dedicata – series minor 107 (The Hague: Mouton, 1972).
32. The works cited by Ruwet are Karl Raimond Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge*, 3rd ed. rev. (London: Routledge and Kegan Paul, 1969); *The Logic of Scientific Discovery*, 6th ed. rev. (London: Hutchinson, 1972); *Objective Knowledge: An Evolutionary Approach*, rev. ed. (Oxford: Clarendon Press, 1979); Friedrich A. Hayek, *The Sensory Order: An Inquiry into the Foundations of Theoretical Psychology* (London: Routledge and Kegan Paul, 1952); *Studies in Philosophy, Politics and Economics* (London: Routledge and Kegan Paul, 1967).
33. Ruwet, 'Théorie et Méthodes', p.13.
34. Nattiez, *Fondements*, p.256.
35. Ibid.
36. Reinhard Schneider, *Semiotik der Musik: Darstellung und Kritik*, Kritische Information (Munich: Wilhelm Fink Verlag, 1980), pp.179-228.
37. Furthermore, it is regrettable that such a study as David Halperin, 'Distributional Structure in Troubadour Music', *Orbis musicae* 7, 1979/80, pp.15-26, which leans heavily on Harris, for example, apparently refuses to acknowledge the existence either of Ruwet's own work or its derivative literature.
38. I would like to acknowledge the assistance of John Taylor (King's College London), who kindly read the translation and offered much advice.



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NICOLAS RUWET

## METHODS OF ANALYSIS IN MUSICOLOGY

*For André Souris [1966]*

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### I

In every semiotic system,\* the relationship between code and message can be described from two different points of view, depending on whether one proceeds from the message to the code or from the code to the message.<sup>1</sup>

In the first case, the procedure is analytic; in principle, it is indispensable whenever, as in the case of an unknown language, of exotic music or myths, etc., the message alone is given. The work of the analyst then consists of deconstructing and manipulating the corpus (all given messages) in various ways in order to derive the units, classes of units, and rules of their combination which together constitute the code. The crucial problem here is that of discovery procedures, in other words, analytical criteria. For twenty years, Structural Linguistics – at least in Denmark and in the United States – was preoccupied almost exclusively by these problems and elaborated various analytical models based on such explicitly defined criteria as the principle of commutation in the glossematic school, or that of contextual substitution in American distributional analysis.<sup>2</sup> An outline of the discovery procedure may be found applied to myth in Lévi-Strauss;<sup>3</sup> more recently, researchers have tackled the problem in semantics as well as in stylistics.<sup>4</sup>

Once the code has been deciphered, a reverse procedure allows the generation of messages from this code according to rules of derivation which can themselves be rigorously clarified.<sup>5</sup> Thus, in contrast to an analytical model, a synthetic model is available which proceeds from the most abstract and general elements and results in specific messages. From this point of view, the grammar of a language, when formulated synthetically, appears as a sort of machine capable of generating all – and nothing but – admissible, ‘well-formed’ or ‘grammatical’ sentences in that language. At first sight, the synthetic model

\* Nicolas Ruwet, ‘Méthodes d’analyse en musicologie’, *Revue belge de musicologie*, Vol. 20, 1966, pp.65-90; reprinted in *Langage, musique, poésie*, Collection poétique (Paris: Seuil, 1972), pp.100-34.

offers nothing new; it is simply the mirror image of the analytical model. Its sole use is to prove the validity of the analytical model. It allows the verification of the latter's faithful representation of the facts and, especially, the proof of its productivity; if the analytical model is correct, its synthetic transformation will generate messages which did not appear in the original corpus (limited by definition) but which will be recognised by subjects as equally well formed.

In fact, this conception of the relationship between the two models – approximately that of Hjelmslev – is oversimplified. The synthetic model has more fundamental purposes. As theoreticians of generative grammar have shown, it seems very difficult to formalise discovery procedures completely, and the rigorous application of such tests as commutation or distribution always leaves remainders; these can be reduced only by the introduction of considerations of a quite different order – such as the principle of simplicity, applied to the whole of the system (the code). On the other hand, it seems false to hold that the initial *data* of the analysis amount to a corpus of messages (to Hjelmslev's 'yet unanalysed text', to the Americans' collection of recorded statements) which would constitute the only means of access to the code. As soon as a rather limited objectivity is abandoned, one realises that the analyst has more varied data at his disposal, for example, all sorts of metalinguistic judgments made by the subjects upon the code which, if handled with caution, furnish a complete series of indices to the structure of the code.<sup>6</sup>

Thus, although the establishment of the code continues to depend on the existence of analytical procedures, these will be necessarily fragmentary and multiple, and it will be only at the level of the formulation of a synthetic model that the code can be described uniformly with maximum internal coherence and simplicity. Furthermore, as experience has shown, the most elaborate analytical models have always had a static character hardly suited to account for two types of fundamental problems, that of creativity, of productivity, of linguistic or semiotic systems, and that of the universal laws which govern these systems. A code consists essentially of two parts: inventories of elements, and rules of their combination and operation. Now, analytical models tend to favour the inventory, whilst neglecting the question of rules. Hence their static aspect – hence also their lack of universality: it is at the level of the inventory of elements that languages (or musical systems) diverge most, whereas the rules which direct these elements present a much more general character.

It was necessary briefly to indicate the limitations of analytical models. If one undertakes to establish discovery procedures in musicology, one risks lingering over apparently very difficult methodological problems whose interest is ultimately limited: at the level of the synthetic model, these problems are no longer relevant. Thus, a question – which can interest musicians – has preoccupied linguists for a long time: must the analysis be conducted proceeding 'from top to bottom' or conversely 'from bottom to top'? For Hjelmslev, the given data comprises the unanalysed text in its totality (which can be very large, as great as the sum of phrases uttered in a given language) and the analysis takes the form of a progressive separation of this totality into ever

smaller parts defined by their mutual relationships – this separation resulting in elements which are ultimately irreducible. Harris, on the other hand, proceeds from relatively brief statements and first derives minimal units – phonemes – which he groups progressively into greater classes of units (morphemes, syntagms, sentences) in order finally to attempt discourse analysis. The results of these two types of analysis, when applied to the same materials, partly overlap but, since, in any case, a single procedure can never suffice, the choice between the two procedures ceases to be crucial: in practice, the two are constantly mixed. Of course, it is very useful to have envisaged precisely the consequences of the use of such and such a particular procedure.

Notwithstanding these reservations, it remains the case that explicit discovery procedures, even if partially insufficient, are indispensable, if only to guarantee that the synthetic model will not change into a normative system. The history of linguistics bears witness to their necessity: it would never have reached the present stage of generative grammar if twenty years of intensive analytical research had not liberated it conclusively from the synthetic but normative systems of traditional grammar.

## II

Let us now consider the present state of musicology from the perspective of the distinction between the two models. It may be noted: a) that the theoretical problem of this distinction has never been raised; b) that no analytical model has ever been explicitly elaborated; c) that musical analyses, even the best – for example the one given by Pierre Boulez of *The Rite of Spring*<sup>7</sup> – do not formulate the discovery criteria on which they depend. In general, most treatises on harmony, fugue, etc., are analogous to traditional grammars: the model is synthetic, only partially explicit, and tainted with normativism. This is well known. More strikingly, the least contestable successes of musicology, in the field of western tonality – Gevaert<sup>8</sup> – as well as in that of exotic or popular scales or rhythms – Brăiloiu<sup>9</sup> – have received a synthetic formulation: the materials are always presented starting from the most abstract elements (the system of the circle of fifths, for example, according to Gevaert) and progressively reconstructing from it the whole diversity of actual messages. Clearly, this synthetic formulation presupposes numerous preliminary analytical procedures – correct to judge by the value of these exercises. But these procedures are almost never made explicit.<sup>10</sup>

I shall illustrate the need for resorting to discovery procedures by considering two types of problems – closely related moreover: that of scales and of modes, on the one hand, and, on the other, that of the segmentation of a work into units of different hierarchic levels.

Gevaert and Brăiloiu both give tables, one of diatonic modes, the other of prediatonic systems, developed deductively. They illustrate them with examples but do not pose the crucial question: given any corpus of modal

melodies how does one recognise that one of these melodies belongs to a given mode? Or again: how does one recognise that a melody passes successively from one mode to another, or that it presents a hierarchic organisation of different modes? The earliest specialists of Gregorian chant had decided, by what appeared as an embryonic discovery procedure, that a melody belonged to the mode whose last note was the 'tonic';<sup>11</sup> but this procedure is far too simplistic. In fact, despite the insistence of various musicologists on the role of melodic formulae, for example, in the determination of mode,<sup>12</sup> there remains a large gap between, on the one hand, specific messages (the corpus of Gregorian chant, for example) and, on the other hand, the system of modes which only constitutes the most abstract part of the code. All the rules allowing one to proceed from the former to the latter (and vice versa) are missing.

Another problem: for everyone, it seems self-evident that a musical work with a minimum of complexity is subject to a hierarchic organisation, and divides into parts on different levels. Thus, according to Ferretti,<sup>13</sup> Gregorian melodies divide into *periods*, these in turn into *phrases*, phrases into *half-phrases*, and the latter into *incises*. Such analyses raise a multitude of questions, not the least of which is the validity of the taxonomic conception of musical structure that they seem to imply (see below). One could also ask whether these notions of period, phrase, etc., are susceptible to general or universal definitions or if, conversely, they must be seen only as *ad hoc* notions, valid only for a given piece. But the crucial question, first and foremost, is the following: *What are the criteria which, in such and such a case, have presided over the segmentation?* Now, nobody takes the trouble to reply to this question, as if the obviousness of the criteria were manifest.<sup>14</sup>

This question involves a series of others. Here are a few of them. If I divide a section A into two segments a and b, are these divisions based on rests, on difference of timbre, opposition of register, melodic and/or harmonic cadences, similarity or contrast of rhythms, equal or unequal duration of segments, etc.? Or is there a combination of these elements in play? Do the divisions rely on similarities of or differences between segments? Can certain criteria be replaced by others? Do I obtain the same results, for example, if I base the segmentation on rests and then on cadences – a correspondence that is found especially in the chorale – or, on the contrary, does recourse to different criteria establish different segmentations which introduce ambiguities into the structure? This case is certainly very common, and its study would be fundamental to an accounting for, among other things, variants of interpretation. Is it possible to impose a hierarchy on the various criteria, the one only intervening if the other allows ambiguities to remain? Can one establish procedures which allow the validation of a chosen criterion?<sup>15</sup> Do universal criteria exist? Would it be useful to distinguish essentially syntagmatic criteria (the rests) from paradigmatic criteria (based on elements' internal and/or external equivalence), or criteria depending essentially on the substance (rests yet again, timbres) from those depending on essentially formal criteria (repetition, variation)?

These questions may well appear futile to musicians and musicologists.

However, their importance in the study of non-European musics is scarcely contestable. On the other hand, the application of explicit discovery procedures to more familiar musical systems can well lead only to obvious conclusions, already intuitively recognised. But that itself is far from being insignificant. It is indeed very useful to be able to verify the elaboration of a procedure step by step by recourse to intuition; once this procedure has been completely determined, it can then be applied to the study of less well-known materials. Moreover, even in fields as well known as that of fugue, well-defined procedures of segmentation lead to the revision of traditional analyses (thus confirming the intuition of the best musicians).<sup>16</sup>

I was saying above that the question of the division (articulation) of a piece and the establishment of scales and modes were related. Indeed, modal structure can serve as a pointer in the process of division, and vice versa. There is therefore a danger of introducing a vicious circle into the procedure. Let us consider the principal criteria adopted by Bruno Nettl<sup>17</sup> to establish the tonic of a given piece. These are: a) greater frequency and duration of a given note in comparison with others; b) final position of this note in individual sections and phrases; c) its terminal position in the song. What interests us here is point b). It presupposes that one already has at one's disposal criteria with which to divide the piece into 'individual phrases and sections' and that, except for the vicious circle, these criteria exclude all reference to the scalar and modal structure (Nettl does not furnish explicit criteria for division). I am not suggesting however that the only possible discovery procedure will proceed from division to scales. One can, on the contrary, imagine the successive use of two procedures, the one proceeding from division to scales, the other from scales to division, with the second confirming the validity of the first; I did indeed stress, at the beginning of this article, that there certainly does not exist an entirely satisfactory discovery procedure: the more one makes use of independent procedures, the better that will be for the final constitution of the code. But it is essential that one of the procedures does not presuppose the results of the other.

### III

In this article, I shall deal especially with the procedures of division, even if it entails, in a given example, indicating their influence on modal analysis. Two methods are available to derive a procedure. One can either begin from already completed analyses, and try to reconstruct the criteria, not necessarily homogeneous, which have dominated there, or choose *one* given principle, perfectly explicit, even if it means accepting that it may prove inadequate, require improvement, and even be rejected. It is this last path that I shall try to follow.

First of all, let us leave aside reference to rests – certainly inadequate if the segmentation is taken far enough – as well as recourse to the linguistic structure



of the words,<sup>18</sup> in the case of vocal music. Let us suppose that one will have only subsidiary recourse to these types of data, either to confirm segmentations provided in other ways, or as indices to possible segmentations, in cases where purely musical analysis runs into great initial difficulties (when for example the criterion of repetition is not immediately applicable). It is thus a question above all of formulating procedures based on specifically musical criteria.

Furthermore, it is useful to introduce a theoretical distinction between two types of musical element which I shall call respectively parametric and non-parametric.<sup>19</sup> A parametric element can take two forms. Firstly, it is an element which is constant throughout the whole duration of a piece, such as for example the tempo in certain Bach allegros, or the monodic character and timbre in a solo vocal melody. Here, clearly, this element is of no help in the segmentation of the piece. Secondly, the element takes the form of a binary opposition which divides the piece into sections characterised by the presence of now the one and now the other term of the opposition; cf. the opposition soloist/chorus in antiphonal singing, the opposition *piano* (= 'solo')/*forte* (= 'ensemble') in Venetian poly-choral music, that between the 'original' and the 'echo' (= 'near'/'far', often also 'complete'/'incomplete') in certain musics of the baroque period, the major/minor opposition in the slow movement of Beethoven's Third Symphony, the opposition of high/low register (it is also an opposition of timbre) in the initial march of Stravinsky's *Renard*, etc.. As these examples show, many of these oppositions are composite and combine several dimensions; these dimensions can be very easily dissociated, in which case the segmentation of the piece will be different according to whether one considers the one or the other. But, in each case, the principle of segmentation will be the same: successive sections are defined in terms of contrasts, and these depend on the presence or the absence in the section of one of the two terms of the binary opposition.

On the other hand, a non-parametric element cannot be reduced to a binary opposition; rather, it is characterised by a fairly large number of internal distinctions of the same dimension (cf. the numerous different intervals produced by the diatonic or chromatic scale or, again, the series of durations, intensities, modes of attack, in serial compositions). As André Souris<sup>20</sup> has shown – in another language – it is not possible to determine *a priori* that such and such a musical dimension has a parametric or non-parametric inclination. Parametric dimensions in one culture, or at one period of history, are non-parametric in another.

In this article, I shall take no account of parametric elements which will therefore be considered constant throughout the duration of the pieces analysed. I shall confine myself to non-parametric elements and shall choose *repetition* as my principal criterion of division. I shall start from the empirical appreciation of the enormous role played in music, at all levels, by repetition, and I shall try to develop an idea proposed by Gilbert Rouget:

. . . Certain fragments are repeated, others are not; it is on repetition – or absence of repetition – that our segmentation is based. When one sequence

of notes appears two or more times, with or without variation, it is considered a unit. As a corollary, a sequence of notes which appears only once is also considered a unit, whatever its length and the apparent number of its articulations (especially silences) . . . <sup>21</sup>

Before going further, it is necessary to specify what one understands by repetition, and to define the assumptions on which the application of the criterion of repetition is based. Repetition signifies identity between segments spaced at different places in the syntagmatic chain. But speaking of identity raises the question: identity from which point of view? Indeed, from a purely physical point of view, two actual events are never completely identical. Some degree of abstraction is therefore inevitable, and the question of its basis should be asked. We will not ask this question here, and will consider certain elementary identities as given. On the other hand, we must decide which dimensions – pitch, duration, intensity, timbre, etc. – will be the basis on which two different segments will be considered as repetitions of one another. Here, given that the examples will be borrowed from the western literate tradition, and will be monophonic, only pitch and duration will be considered. But it must be remembered that segments, variable as to pitch and duration, can be considered as repetitions as long as they are identical in other respects.

One therefore treats as data minimal elementary identities of pitch and duration. More precisely, one can express the situation by saying that one initially possesses some mechanism which is capable of recognising a pitch, an interval, or a definite unit of duration (for this mechanism, a *c'* is always a *c'*, a minor third is always a minor third, and a minim a minim). Moreover, in the particular procedure chosen here, identities of pitch and duration are treated *together*, at least at the beginning: only segments which are at once simultaneously identical from the perspectives of pitch and duration are considered identical. At a later stage of the procedure, the two dimensions may possibly be disassociated to provide units which, as repetitions of one another from one only of the two points of view, will be considered as transformations of one another (or variations). This procedure seems to have suited the type of material used (it saves time: a procedure which separated the two dimensions would have ended up with the same results, but by a longer route), but it is not obligatory; there are musics – fourteenth-century isorhythmic motets especially – which require one to separate the two dimensions from the outset.

#### IV

This much said, here, in its broadest outlines, is the description of a procedure of division, based on the principle of repetition, and applied to monodies.

(a) Our 'machine for identifying elementary identities' passes along the syntagmatic chain and identifies similar fragments. One considers as level I



units sequences – the longest possible – which are repeated in their entirety, either immediately after their first statement or after other intervening segments. This first operation yields such structures as  $A + X + A$ ,  $A + A + X$ ,  $A + X + A + Y + A$ ,  $A + A + B + B + X$ ,  $A + B + A + X + B + Y$ , etc. (repeated sections, level I units, are represented by the first letters, the ‘remainders’, by the last letters of the alphabet).

(b) The remainder or remainders are considered provisionally as units of the same level I (cf. the quotation from G. Rouget); this analysis is strengthened or weakened by recourse to other criteria. The total duration of the segments can yield an initial index: if, by the operation (a), one has derived a structure  $A + A + X$ ,  $X$  will in principle be considered as a unit of the same level as  $A$  if its total duration is approximately the same as that of  $A$  (in this case, to show that (b) has taken place, one may, in the notation, replace  $X$ ,  $Y$ ,  $Z$ , etc., by  $B$ ,  $C$ ,  $D$ , etc., and  $A + A + X$  is written  $A + A + B$ ). It should be noted that, in having recourse to the equivalence of the segments’ duration, we are only applying the principle of repetition on a more abstract level:  $X$  is, from the point of view of its absolute duration, all other things being equal, a repetition of  $A$ .

(b<sub>1</sub>) The results of (b) can then be consolidated by recourse to indices provided by the rests, or by linguistic analysis of the words in the case of vocal music.

(c) If operations (b) and (b<sub>1</sub>) have failed to result in, and if the remainders are not admissible as, level I units, two alternatives emerge: (1)  $X$ ,  $Y$ , etc., are much shorter than  $A$ ,  $B$ , etc.; these remainders are put off to a later stage in the analysis, awaiting the results of following operations (d); (2) the remainder is much longer than  $A$ ,  $B$ , etc.; in this case, either, thanks to the operations of (b), (b<sub>1</sub>), (d) it can be segmented<sup>22</sup> into level I units, which will be transformations of  $A$ ,  $B$ , etc. – and then, for example,  $A + A + X$  will be described as  $A + A + B + C$  – or else it will reduce later – after a new application of (a) to units derived at level I – into units of level II, or, finally, it must be considered as an unanalysable unit of level O (see below, (e)).

(d) Often, one will be led to consider various units – both among  $A$ ,  $B$ , etc. and  $X$ ,  $Y$ , etc. – as being *transformations* (rhythmic and/or melodic variants) of one another. Thus, for example,  $A + A + X$  will be rewritten  $A + A + A'$ , or again  $A + B + A + B$  will be rewritten  $A + A' + A + A'$ . It would be essential to draw up a list of types of possible transformations and to describe the procedures which allow their derivation. I shall limit myself to a few remarks (leaving aside the question of transpositions, particular transformations which scarcely pose any problems).

(d<sub>1</sub>) A first class of transformation will be derived if one applies, as has already been suggested above, the principle of repetition *separately* to pitches and durations. One then obtains rhythmic transformations of the same melodic structures, and vice versa.

(d<sub>2</sub>) Other transformations will introduce such more complicated operations as permutations, additions or subtractions of certain elements. I shall not enter here into the detail of these operations, except to note a few in the course of the

analysis of the examples.

(d<sub>3</sub>) It is important to note that, in order for a section, B or X, to be considered a transformation of another section A, it is often necessary to go through a new application of the operation (a) at a lower level; this then derives the level II units, such that, for example,  $A = a + b$ , and  $X = a + c$ . Thus, a part of X appears as a strict repetition of A and, from other points of view – absolute duration, rests, text structure, etc. – as long as X is equivalent to A, X will be considered a transformation of A:  $X = A'$ . We see here an example of the necessity, in the course of the procedure, to *shunt*, that is to say to proceed now from top to bottom, now from bottom to top. Another example of this was given at the very beginning, since, having started from ‘the bottom’ – the elementary units of duration and pitch – we then, with the operation (a), proceeded from ‘the top’.

(d<sub>4</sub>) Often, in deriving transformations – especially by the operation (d<sub>1</sub>) – one is led to revise an initial segmentation, established by (a) and (b). Let us suppose that these two operations have resulted in a structure  $A + x + A + y$  (with very short remainders). If (d<sub>1</sub>) shows that  $A + x$  is identical to  $A + y$  from the point of view of durations, for example, and if other factors intervene as well – such as the absence of a rest between A and x, A and y, but the presence of a rest between x and A – it may be stated that  $A + x$  is a single unit, of which  $A + y$  is a transformation, and one will rewrite the structure as  $A + A'$ .

(e) We can now tackle a problem of which (d<sub>4</sub>) is only a particular case. Let us suppose that the operation (a) has produced such structures as

1)  $A + X + A + Y \dots$

or

2)  $X + A + Y + A \dots$

A question arises which we had first of all ignored: can one not consider that, in (1),  $A + X$  and  $A + Y$ , and in (2),  $X + A$  and  $Y + A$ , constitute units of a level higher than level I (let us call this level O)? The operation (a) affords no means of replying to this question, and one is obliged to resort to subsidiary criteria. Here are the two most important; both appear to me to be equally necessary to describe (1) as  $(A + X) + (A + Y)$ , and (2) as  $(X + A) + (Y + A)$ .

(e<sub>1</sub>) The ending of X and Y in (1), that of A in (2) – in contrast to that of A in (1), those of X and of Y in (2) – are marked in a special way, by the rest and/or the elongation of the final note (compared with the absence of a rest and/or elongation in the other units).

(e<sub>2</sub>) Later analysis – that is to say, essentially, the operations grouped under (d) – shows that Y is a transformation of X.

It remains to be said that once the units of level I have been derived, the procedure must be applied again, beginning with operation (a), in order to derive the units of level II, and so on, until one arrives at units which merge into the elementary units from which one began.

## V

Let us now illustrate the procedure by examples, beginning with the most simple. Any difficulties encountered, and problems raised, will appear progressively. First, a fourteenth-century German *Geisslerlied: Maria muoter reinû maît* (cf. Ex. 1).<sup>23</sup> A few words first of all on the graphic presentation of the examples. I have found it illuminating, in the study of monodies, to follow a procedure applied to the analysis of myths by Claude Lévi-Strauss – the latter who was himself influenced by the musical notation of orchestral scores.<sup>24</sup> Equivalent sequences are, as far as possible, written one below another in a single column, and the text is to be read, ignoring the spaces, from left to right and from top to bottom. Thus, certain traits of structure become immediately apparent, as are certain ambiguities. Clearly, it would be very difficult to apply the same procedure to the presentation of polyphonic structures.

It must be stressed that, in the actual functioning of the analysis, various stages of the procedure do not necessarily follow in the given order. The procedure is much more one of verification, meant to ensure that the analysis is coherent, than a discovery procedure in the strict sense of the term. Doubtless, it would always be possible to apply it rigorously in the given order, and one would obtain the same results, but it is much faster and more economical to make use of it in order to verify the results of an analysis obtained purely intuitively and sometimes very rapidly. This is a situation well-known to linguists.<sup>25</sup> Therefore, in the analysis of the examples, and so as not to prolong the demonstration inordinately, I shall often allow myself to be quite elliptical, confident that the reader will be able to reconstitute for himself the series of operations which have been carried out.

Let us consider our *Geisslerlied*. A first application of the procedure derives, at level I, the structure  $A + A' + B + B$ , without any remainder ( $A'$  to take account of slight variants,  $b$  against  $b'$ ,  $bb$  against  $a$ , and then the crochet  $a$  divided once into two quavers).<sup>26</sup>

The explicit series of operations would have in fact given:

- (a)  $X + B + B$ ;
- (b) a negative result: no equivalence of absolute duration between  $X$  and  $B$  (no more than between  $A$  and  $B$ );
- (c), (d):  $X = A + A'$ ;  $A'$  is a melodic transformation (without change in duration) of  $A$  (cf. d<sub>1</sub>); it is certain that, intuitively, one would have already derived the level II units, and that it is in terms of  $b$  and of  $b'$  – rather than of  $A$  and  $A'$  – that one would have identified the transformations.

If, despite the negative result of (b),  $A$ ,  $A'$  and  $B$  are considered units on the same level (I), this is particularly because of the results of (d), and because at the later stage,  $A$ ,  $A'$  and  $B$  will appear to be made up in part of identical elements (cf. d<sub>3</sub>).

A second application of the procedure gives level II units, obtained for example in the following manner:

Ex. 1a: *Geisslerlied*

## Ex. 1b

## Ex. 1c

## Ex. 1d

- (a)  $A' = x + b + y + b$ ;
- (b)  $A' = a + b + c + b$  (durations of a, b, c are identical);
- (d)  $A = a + b + c + b'$  ( $b' = T^m$  – abbreviation for melodic transformation – of b);
- (a)  $B = z + b'$  ( $b'$ , identified in A, is found here);
- (b)  $B = d + b'$ .

A third application of the procedure gives the units of level III (designated by the means of subscript numbers to the designations of the level II units, e.g.  $a_1$ ):

- (a)  $d = d_1 + d_1$ ;
- (a)  $c = c_1 + d_1$ ;
- (b)  $a = a_1 + a_2$ ,  $b = b_1 + b_2$ ,  $b' = b'_{[1]} + b_2$  (all these units being equivalent in duration to  $d_1$ ); in addition:

( $d_1$ ) (cf. Exs 1b and 1c):  $a_1$ ,  $b'_1$ ,  $b_1$ ,  $c_1$ ,  $a_2$  are all melodic transformations of the same rhythmic structure (four crochets); similarly,  $b_2$  is a  $T^m$  of  $d_1$ .

Finally, a fourth application of the procedure allows the derivation of a certain number of units which are either repetitions or various types of transformations (transpositions, inversions, recurrences,  $T^m$ ) (cf. Ex. 1d). What prevents us from talking of units of level IV, besides the fact that they are of very unequal length (some are as long as the level III units), is that these units encroach on one another in various ways. The discontinuous character of units and levels – which appears essential to a taxonomic conception of the musical structure – thus appears obscured there. If, on the other hand, one pushes the segmentation further, one ends up with the minimal units postulated at the beginning, and the procedure has exhausted its results.

Let us single out as one of the essential results of this analysis the asymmetry that it uncovers, at all levels: asymmetry between A (varied to  $A'$ , and composed of three sub-units) and B (not varied on repetition, and composed of two sub-units), asymmetry between a, b, c (composed of two different segments) and d (composed of two identical segments), a more subtle asymmetry between a (whose two sections are only  $T^m$  of each other) and b, c (whose two segments are varied at once melodically and rhythmically), and finally, asymmetry as the result of the encroachments of the 'level IV units'.

## V.1

This analysis has not had recourse, at any of its stages, to data relative to scale or mode. On the other hand, it is possible to use its results to derive the modal structure of the piece. A clear-cut hierarchy of the different notes used results from the analysis into units of different levels, and this hierarchy does not entail the introduction, at least not directly, of quantitative criteria. The principal criterion singled out is that of the initial, final or intermediary position which the notes occupy in various units. Initial and final positions are considered as taking priority,<sup>27</sup> and it is accepted that the initial and/or final positions in the units of a higher level carry more weight than the same position in units on a

lower level.

1. *f* is the first and last note of A, A' and B; *f* is also the first note of *a*<sub>2</sub> and *d*<sub>1</sub>;
2. *c* is the final note of *a*;
3. *a* is the first note of *b*, final note of *c*, final note of *a*<sub>1</sub>, *b*<sub>1</sub>, *b*'<sub>1</sub>, *c*<sub>1</sub>, *d*<sub>1</sub>;
4. *d* is the first note of *c*, and absent everywhere else;
5. *bb* is the first note of *b*<sub>2</sub>; everywhere else, it is in an intermediary position (note however that *b* is the most 'welded' [*soudée*] of the level II units, both because *bb* moves from *a* to *a*, and as a result of the encroachment of *b*<sub>2</sub> and of the unit of 'level IV', which is a retrograde transformation of *d*<sub>1</sub>; thus, even here, the position of *bb* is very close to a position of transition);
6. *g* only appears in a position of transition. A secondary criterion – derived in practice from the first – takes into account the role of different notes as passing notes, ornaments, etc., their place in conjunct vs disjunct motions, and the fact that they are or are not immediately repeated;
7. *f*, *c*, *a*, *d* are the only notes to be linked – inside a unit, or at the boundary between two units – by disjunct motion;
8. *bb* and *g* only ever appear in conjunct motion, ascending-descending or descending for *bb*, ascending or descending for *g*;
9. *f* (as the final note of A and of B), *c* (as the final note of *a*) and *a* (at the boundary between *c* or *d* and *b* or *b'*) are the only notes to be repeated immediately;
10. the variant *b* against *b'* accentuates *bb*'s character as a passing note and the stronger position of *a*.

All these traits allow the derivation of a very clear modal hierarchy that one could characterise as *f* major, with an oscillation towards the relative minor in *c*, and some traces of pentatonicism. But it must be noted that these aspects – *f* major, pentatonicism – only have significance if one places this piece within a larger context. If one limits oneself to a particular system of which our *Geisslerlied* is the sole message, to speak of major (without the leading note, *e*) or of pentatonicism (*f*–*g*–*a*–*c*–*d*, when nothing authorises us – on the contrary – to lend more weight to *g* than to *bb*) is equivalent to a distortion of the facts. Only if one replaces this piece in a much larger corpus does it appear as a case of major or of pentatonicism, and its underlying system appear as a sub-code of the tonal system or a sub-code of the pentatonic system.

## VI

Let us take another example, a *chanson* by the *trouvère* Guiot de Provins: *Molt me mervoil* (cf. Ex.2).<sup>28</sup>

1. An analysis based on the metre and the rests would immediately give eight distinct level I units; our procedure ends in the same result by the following route:<sup>29</sup>

- (a) X + B + Y + B;
- (b) X = A (same duration as B);

## Ex. 2a: Guiot de Provins



(c) and (d): Y resolves into units of equal length to A or B (I shorten the procedure, which implies shunting – reference to level II units – and recourse to transformations:  $C = C'$ ), whence the structure:

$$A + B + C + D + E + F + C' + B$$

2. The application of (a) – and if necessary of (d) – to a lower level produces a series of level II units, as in the following table:

$A = x + a$	$B = y + b$
$C = z + a$	$D = w + b$
$E = v + a''$	$F = ?$
$C' = z' + a'$	$B = y + b$

This table suggests two things. First, F is the sole unit that does not allow resolution; this fact introduces an asymmetry all the more striking as F is the only unit to end on *g* (as opposed to *c*, or  $c + bb$ , in the other units). Secondly, one should ask if it is necessary to consider the remainders, *x*, *y*, *z*, etc., as being second-level units of the same status as *a* and *b*. There is in fact a difference of duration between these remainders and the other units whilst, at the same time, the remainders do not represent simple transformations of these other units; furthermore, there exist transformational relationships between some of these remainders – all have the same duration – but these relationships are not always simple. It thus seems better to account for their structure by maintaining a different notation.

3. One can now consider whether the level I units: A, B, etc., do not group themselves in units of a higher level (level 0). The criteria controlled in (e) are without effect, but another criterion – which is in a way an elaboration of ( $e_2$ ) – is visible if one recognises that  $(A + B)$ ,  $(C + A)$ ,  $(C' + B)$  are so many manifestations of a single abstract structure defined in terms of the relationship between units of level II; this structure is described by the following formula (where the brackets indicate that a choice must be made between the units



Ex. 2b



Ex. 2c



Ex. 2d



Ex. 2e



which they enclose):<sup>30</sup>

$$\left\{ \begin{array}{c} x \\ z \end{array} \right\} \quad a \qquad \qquad \left\{ \begin{array}{c} y \\ w \end{array} \right\} \quad b$$

The case of F raises a problem. Since E has an internal structure which corresponds to the first part of the formula,  $(v + a'')$ , one would say that F is, from an external (distributional) point of view, equivalent to the second part of the formula, but that it differs from it in its internal construction.

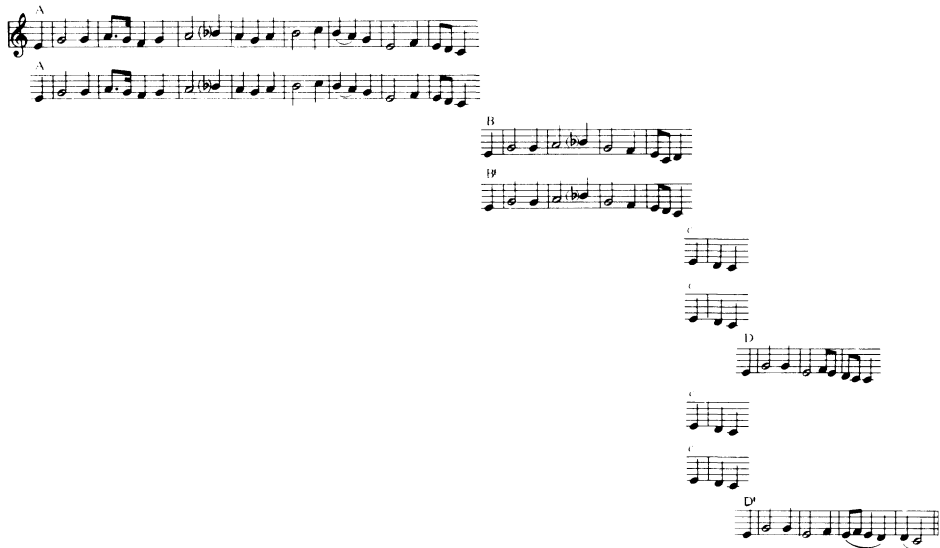
4. If one wishes to take the analysis further, one can ask whether it is necessary to posit an intermediary level between level II and that of the minimal units. From the perspective chosen in this article, a level is defined by the existence of segments which do not encroach upon one another and of which some at least are repeated in different environments. If one has, for example, a sequence  $a + b$ , and if neither  $a$  nor  $b$  appears separately – that is to say, if one encounters neither  $a + c$  nor  $d + b$  – it is unnecessary to posit a level of which  $a$  and  $b$  would be units;  $(a + b)$  must be considered as a single unit. Now, in the *chanson* by Guiot de Provins, one finds no further autonomous segments repeated below level II but only, occasionally, segments which are simple transformations of each other. I leave open the question of whether this is an element adequate for the positing of an autonomous level. (Some of these cases of transformation will be found in Ex.2, especially 2b). On the other hand, it is very important to realise that, insofar as these transformational relationships link either immediately successive segments inside the same unit, or segments belonging to different level I units, but not appearing ‘in the same place’ in these units, these transformational correspondences have the effect of creating between the units of level I some sort of relationships which are, it may be said, ‘oblique’ (in comparison with the relationships of equivalence represented by a vertical axis). In Ex.2 are indicated a few of these transformations which have the effect of blurring the boundaries between the units of level II. Particularly noteworthy are those: (i) which link B and D to C (cf.Ex.2e), introducing an oblique relationship in comparison with the contrast between A, C and B, D, and (ii) which link F respectively to B, C' and E (cf.Ex.2d), thus connecting F to the rest of the piece, from which, in terms of level II units, F appeared to be detached.

## VII

Here is another example, the famous *estampida: Kalenda maya* by Raïmbaut de Vaqueiras (cf.Ex.3).<sup>31</sup>

1. By the application of (a), a unit A is derived without difficulty and immediately repeated; then, by (a) and (c), two sequences  $B + x$  and  $B + y$  are derived which, by virtue of (d<sub>4</sub>), are rewritten B and B' – in a transformational

## Ex. 3a: Raimbaut de Vaqueiras



relationship: B = in suspense, B' = conclusive; then a problem arises: must one consider the sequences represented in the table respectively by c and by D (or D'), as distinct level I units or, on the contrary, starting from the principle that one tries first of all to derive the longest possible units, should one group them as a single unit (c + c + D, then c + c + D') that would be rewritten C (C' at its second appearance)? In fact, it is not possible to give an unequivocal response to this question, and this is certainly a case of ambiguity written into the structure itself. Without doubt, by its length (criterion (b)), c can be assimilated into units of a lower level, all the more since c appears effectively as a T<sup>r</sup> (= rhythmic transformation) of the final 'motif' of A and B'. On the other hand, c shares with the level I units, A and B, the privilege of being immediately repeated after its first appearance, which, in a sense, puts it on the same footing as these units. Finally, D begins and ends in the same way as A and B, and we will see that these three units stand in a transformational relationship; to fuse D with c in the single unit C would make it lose this characteristic. That is why I think that one can represent a first segmentation of the piece by the following formula, which preserves the ambiguity:

$$A + A + B + B' + c + c + D + c + c + D'$$

2. We have ignored another ambiguity. In terms of absolute durations, A is

Ex. 3b<sup>32</sup>

Ex. 3b shows three staves labeled A, B, and D. Staff A contains two segments labeled  $[A_1]$  and  $[A_2]$  with brackets 'a' and 'b' underneath. Staff B and D show corresponding musical material.

Ex. 3c

Ex. 3c shows staves A and B, and segments labeled  $T^m$  [partially  $T'$ ],  $b$ , and  $B$ .

twice as long as B. This fact, together with the fact that B is the only unit so far derived not to end on  $c$  (hence its suspensive character), leads one to think that, in a sense, A is equivalent to  $(B + B')$  – hence a possible division of A into  $A_1 + A_2$ . But (cf. Ex. 3b) another transformational relationship, which one can call a reduction ‘through the middle’, links A to B and to D. By being transformed into B and then into D, A is reduced, in two stages, to its initial and final ‘motifs’, a and b, whose autonomy is thus exposed. Finally, (most often melodic) transformations, on the one hand, link these motifs a and b to other elements (especially, c is a  $T'$  of b), and, on the other hand, sketch the contours of segments of intermediary levels (cf. Ex. 3c).

To sum up, if the analysis quite clearly produces – on two extreme levels, higher and lower – units which satisfy criteria of repetition, of non-encroachment and of autonomy, it also reveals multiple structural ambiguities, not only at the intermediary levels, but even in the relationships between the units of the two extreme levels (cf. the case of c). The result is that, if the notion of a unit keeps its value, that of the level (i.e., that of distinct levels) tends to become blurred.

## VIII

A last example, which is also a *troubadour chanson*: *Be m'anperdut* by Bernard de Ventadour (cf. Ex. 4).<sup>33</sup>

An initial application of (a) readily produces the structure  $A + A + X$ . However, the difficulties begin immediately one tries either to reduce the remainder  $X$  or to segment  $A$  into smaller units. In this last case, another application of the procedure at a lower level only yields very short units, reduced to one, two or three notes (Ex. 4c); at intermediary levels, one only finds segments with quite badly defined contours, linked only by relationships of transformation and not of simple identity, and whose autonomy is weak.

As for the remainder  $X$ , the application of (a) and of (d) produces a long final segment ( $A_{1.2}$ ) which is a repetition, with slight transformations, of a large part of  $A$ . But this segment is itself preceded by a shorter segment, of five minims ( $A_{1.1}$ ) in a double transformational relationship to the beginning of  $A$  (cf. Ex. 4b): on the one hand, it is equivalent, in absolute length, to the whole of the beginning (everything which precedes the equivalent of  $A_{1.2}$ ), and, on the other hand, it represents a melodic transformation by 'diatonic filling-in' of the motif of minims  $a - c - d - f$ . The lack of autonomy of these two segments  $A_{1.1}$  and  $A_{1.2}$ , as well as the great length of  $A_{1.2}$  in comparison with  $A$ , prevents their being considered as constitutive units of an intermediary level. One can group them in one segment  $A_1$ , which, from certain perspectives, could be placed on the same level as  $A$  – absolute duration, similarity of termination ( $A_{1.2}$ ) – but which, from other viewpoints, particularly absence of the initial motif, seems only to be equivalent to a fraction of  $A$ .

Having extracted  $A_1$  from  $X$ , there now remains, at the beginning of Ex. 4b, a segment ( $A_{1.2}$ ) which, with transformations a little more complex<sup>34</sup> than in the case of  $A_{1.2}$ , corresponds to a shorter part of the end of  $A$ . The relative autonomy of this segment could also lead one to postulate a division of  $A$  into two parts of nearly equal length ( $A = Y + A_{1.2}$ ), but this would be to posit a unit ( $Y$ ) which, partially encroaching on  $A_{1.2}$ , does not have, any more than the latter, a well-defined existence.

Finally, it is Ex. 4c which gives the clearest picture (although not exhaustive, it does not indicate the relationships between small units, which could easily be detected) of the structure of the piece. The segments in brackets correspond to 'large units', partially fitting in to one another; the short segments that are

## Ex. 4a: Bernard de Ventadour



## Ex. 4b



found in the same vertical columns correspond to the small units; finally, the segments represented on the same stave, in the same horizontal line, represent intermediary units. This table also quite clearly discloses a compositional procedure which consists of inserting – or of suppressing – short segments inside larger segments.

## SUMMARY AND CONCLUSION

Starting from the distinction between analytical model and synthetic model, I have stressed in this article the necessity of developing the analytical point of view in musicology, or in other words, the urgent need to elaborate rigorous procedures for deciphering the code from messages. At the same time, I have stressed the limitations of this type of procedure. I have principally sketched out a procedure of segmentation, based on the criteria of repetition and transformation, and I have tried to apply it to a few medieval monodies.

It is too early to draw conclusions from a study which represents only the beginnings of research. Many things stated here will need to be taken up and elaborated: that is the case with the distinction between parametric and non-parametric elements, as well as the very notion of transformation. In particular, it will be necessary to invent discovery procedures for recognising, precisely, transformational relationships between elements. These relationships, except in very simple cases, have here been considered as self-evident.

Ex. 4c

The musical score for Ex. 4c is presented in two systems, each enclosed in large curly braces. The notation is on a single staff with a key signature of one flat (B-flat) and a common time signature (C). The first system is marked with a brace on the left and a brace on the right labeled 'A twice'. The second system is marked with a brace on the left labeled 'A' and a brace on the right labeled 'X'. The notation includes various musical symbols such as notes, rests, and accidentals, with some notes marked with a '13' and others with a '11'.

System 1 (Top):

- Staff 1: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 2: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 3: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 4: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 5: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 6: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.

System 2 (Bottom):

- Staff 1: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 2: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 3: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 4: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 5: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.
- Staff 6: A series of notes, including a B-flat, followed by a series of eighth notes and a final B-flat.



I would however like to draw attention to two of the results of this study.

1. It seems to be the case that, at least in certain cases (those where the segmentation into units of distinct levels is unproblematic) (cf. the following paragraph), a procedure of segmentation of the type presented here can have important consequences for scalar and modal analysis. It can serve as an alternative to or as a control over more traditional analyses. Through lack of space, I have hardly stressed this point, but, for example, even the rapid application of the procedure sketched in section V.1 to the melodies analysed from the modal point of view by Edmond Costère<sup>35</sup> immediately shows up the error of these analyses. Moreover, one can begin to make out a procedure of discovery applicable to the question of *pyens*, a procedure which, elaborated in terms of distribution of intervals, would complete and systematise Brailoiu's contribution.
2. Precisely because it attempts to define rigorously levels and units, the procedure we have followed has led us – by different paths from those followed by André Souris – to challenge a purely taxonomic conception of musical structure. Even in such a simple case as that of Ex.1 (cf. section V), it is impossible to represent the structure completely in the form of a series of interlocking structures, with level I units wholly resolving into discontinuous level II units, and these in their turn into discontinuous level III units, etc. The main reason for this state of affairs stems evidently from the fact that musical syntax is a syntax of equivalences: the various units have between them all sorts of relationships of equivalence – relationships which can unite, for example, segments of unequal length – one segment will seem to be an expansion, or a contraction, of another – and also segments encroaching on one another. The consequence of all this is, as has been seen, that it is impossible to represent the structure of a piece of music by a single arrangement.

## NOTES

1. In this article, I shall treat music as a semiotic system, sharing a certain number of common traits – such as the existence of a syntax – with language and other systems of signs. I shall leave completely aside the genuinely aesthetic aspect and especially the question of whether aesthetics can be reduced to semiotics. Moreover, in the field of terminology, because of the reference to notation necessarily implied in the use of the word 'text' in music, I shall use, in preference to Hjeltmlev's dichotomy of system and text, Jakobson's, derived from the theory of communication, of code and message.
2. Louis Hjeltmlev, *Prolegomena to a Theory of Language*, trans. from the Danish by Francis J. Whitfield, rev. ed. (Madison, Wisc.: University of Wisconsin, 1970); Knud Togeby, *Structure immanente de la langue française*, Travaux du cercle linguistique de Copenhague 6 (Copenhagen: Nordisk Sprog- og Kulturforlag, 1951); Zellig Sabbettai Harris, *Methods in Structural Linguistics* (Chicago: Chicago University, 1951); *Discourse Analysis Reprints*, Papers on Formal Linguistics 2

- (The Hague: Mouton, 1963); Paul Lucian Garvin, *On Linguistic Method: Selected Papers*, Janua linguarum: studia memoriae Nicolai van Wijk dedicata – series 30 (The Hague: Mouton, 1964).
3. Claude Lévi-Strauss, *Anthropologie structurale*, 2 vols (Paris: Librairie Plon, 1958), trans. Claire Jacobsen and Brooke Grundfest Schoepf as *Structural Anthropology* (New York: Basic Books, 1963; 2/London: Allen Lane, The Penguin Press, 1968), Chapter 11, 'The Structure of Myths'.
  4. Cf. especially Algirdas-Julien Greimas, *Sémantique structurale: recherche de méthode. Langue et langage* (Paris: Librairie Larousse, 1966); Michael Riffaterre, 'Criteria for Style Analysis', *Word*, Vol. 15, 1959, pp.154-74; 'Vers la définition linguistique du style', *Word*, Vol. 17, 1961, pp.318-44.
  5. Cf. the work of the school of generative-transformational grammar in the United States and particularly Noam Chomsky, *Syntactic Structures*, Janua linguarum: studia memoriae Nicolai van Wijk dedicata 4 (The Hague: Mouton, 1957); *Current Issues in Linguistic Theory*, Janua linguarum: studia memoriae Nicolai van Wijk dedicata – series minor 38 (The Hague: Mouton, 1964) as well as Emmon Bach, *An Introduction to Transformational Grammars* (New York: Holt, Rinehart, and Winston, 1964).
  6. Noam Chomsky, 'Some Methodological Remarks on Generative Grammar', *Word* Vol. 17, 1961, pp.219-39. In a way, Chomsky takes up the conviction expressed by Claude Lévi-Strauss that the analysis of myths is only possible starting from two types of data: the texts and their ethnographic context; the internal analysis of texts is necessary, but it is insufficient (cf. Claude Lévi-Strauss, 'Le structure et le forme: réflexions sur un ouvrage de Vladimir Propp', *Recherches et Dialogues Philosophiques et Economiques*, 19 vols, ed. Jean Lacroix, Cahiers de l'Institut de Science Economique Appliquée M:1-19 (Paris: Institut de Science Economique Appliquée, 1960), Vol. 7, pp.3-36. In music, one can see quite well to what certain of these additional data can correspond: the analyst does not only have at his disposal a corpus of recorded pieces but also the descriptions of instruments, information on how they are played, data on the conditions of performance, various commentaries – be they only the titles of works – which are as much direct or indirect indices to the structure of the code.
  7. Pierre Boulez, 'Strawinsky demeure', *Musique russe*, 2 vols paginated consecutively, ed. Pierre Souvchinsky, Bibliothèque internationale de musicologie (Paris: Presses universitaires de France, 1953), Vol. 1, pp.151-224.
  8. François Auguste Gevaert, *Traité d'harmonie théorique et pratique*, 2 vols (Paris: Henry Lemoine, 1908). I mention in passing my gratitude to André Souris who drew my attention to this fundamental work, now almost impossible to find, and who was one of the few to have appreciated all its value.
  9. Constantin Brăiloiu, 'Le giusto syllabique bichrone', *Polyphonie*, Vol. 2, 1948, pp.26-57; 'Sur une mélodie russe', *Musique russe*, 2 vols paginated consecutively, ed. Pierre Souvchinsky, Bibliothèque internationale de musicologie (Paris: Presses universitaires de France, 1953), Vol. 2, pp.329-91; 'Le rythme enfantin: notions liminaires', *Cercle international d'études ethno-musicologiques*, Wégimont, 19-26 Septembre 1954, ed. Paul Collaer, Les Colloques de Wégimont 1 (Brussels:

- Elsevier, 1956), pp.64-96.
10. One certainly finds in the works of Gevaert or Brăiloiu plenty of materials which allow, in certain cases, the reconstruction of an analytical model. See, for example, Gevaert, *Traité d'harmonie*, Vol. 2, pp.64-5. Brăiloiu, 'Mélodie russe', gives a certain number of indices by which *pyens* are analytically recognised, but he does not group them in a systematically ordered procedure – which leads him to certain errors of interpretation, cf. Ex. 10, p.343. Let us nevertheless add that the problem of discovery procedures is beginning to preoccupy some musicians – it is posed, at least implicitly, by André Souris (cf. for example 'Phrase', *Encyclopédie de la musique*, 3 vols (Paris: Fasquelle, 1958-61), Vol. 3, p.437) – and ethnomusicologists who are led there inevitably from the question of transcription (cf. the works in progress of Gilbert Rouget, as well as Nicholas M. England *et al.*, 'Symposium on Transcription and Analysis: A Hawke Song with Musical Bow', *Ethnomusicology*, Vol. 8, 1964, pp.223-77).
  11. Cf. especially Gustave Reese, *Music in the Middle Ages* (New York: Norton, 1940), pp.161-2.
  12. Cf. for pentatonicism, Brăiloiu, 'Mélodie russe', pp.351-2. It is clear that formulae – different types of *incipit*, etc. – are used only for illustrative purposes. The problem arises moreover as to how the autonomy of these formulae is established, which again poses the question of discovery procedures, in another domain (see below, problems of segmentation).
  13. Reese, *Music in the Middle Ages*, p.169, and the articles by André Souris in *Encyclopédie de la musique*, 3 vols (Paris: Fasquelle, 1958-61).
  14. In my own analyses of Debussy – cf. Nicholas Ruwet, 'Note sur les duplications dans l'oeuvre de Claude Debussy', *Revue belge de musicologie*, Vol. 16, 1962, pp.57-70; reprinted in *Langage, musique, poésie*, Collection poétique (Paris: Seuil, 1972), pp.70-99 – the segmentation of analysed fragments is taken as acquired data: see, for example, the analysis of the passage of *Fêtes* into sections and subsections (p.75). Nevertheless, I give a rudimentary rough sketch of the discovery procedure *à propos* the Prelude of *Pelléas* (p.90) [page numbers refer to those of the reprint].
  15. For example: let us suppose that, in using the rests, I divided the given section into two segments A and B, this segmentation has a good chance of being confirmed if, searching for equivalences in the internal structure of A and of B, I discover that A and B have the same absolute duration (in terms of time, of bars, etc.) and/or that  $A = a + b$ , and that  $B = a + c$  (so that A and B are equivalent from a certain point of view).
  16. The application of a procedure broadly analogous to that based on the principle of repetition, which is exposed below, to the fugues in the *Well-Tempered Clavier*, allows the derivation of units of various levels, often corresponding to units defined by traditional theory (exposition, episode, subject, etc.). One can however determine in a purely formal manner that it is impossible, in the case of a particular fugue, to speak, for example, of counter-subject or primary subject, etc.
  17. Bruno Nettl, *Music in Primitive Culture* (Cambridge, Mass.: Harvard University, 1956), p.46. I do not necessarily wish to take responsibility for the idea that it is possible to determine a tonic in non-tonal music – cf. Brăiloiu, 'Mélodie russe',

pp.346-7, on the instability of the tonic in pentatonic systems. The discussion here is purely of method. It is to be noted that Nettl mixes quantitative (a) and qualitative (b) criteria. It might have been appropriate to separate them more clearly, and to try to define scales in purely structural terms. In any case, the relative frequency of such and such a note does not appear decisive to me.

18. It is obvious that the linguistic structure of the text must form part of the analysis of vocal music. But this obvious point does not allow the mixing of the two levels, as is current in the study of the 'forms' of the medieval *chanson*. Reese, *Music in the Middle Ages*, p.224, analyses *Por conforter ma pesance* by Thibaut of Navarre as follows:

(1)  $a + b + a + b + c + d + E$ .

If one provisionally leaves aside the contrast between the chorus (E) and the soloist, a musical analysis based on the criteria of repetition gives a primary segmentation into  $A + A + X$ ; at a second level, A resolves into  $a + b$ , and X into  $a' + c$  ( $a' = a$  transposed). Hence:

(2)  $a + b + a + b + a' + c$  (c then is divided on the basis of a totally different principle, the opposition chorus/soloist). The linguistic analysis gives a different structure; from the point of view of rhymes (which is only one of its aspects), one has (3) which can be superimposed on (2) in the following manner:

(3)  $m + n + m + n + n + m + p$

(2)  $a + b + a + b + a' + c$ .

This analysis has only a demonstrative value; it seeks above all to react against a tendency to level out linguistic and musical realities by projecting multidimensional structures onto a single plane. Let us add that, in the purely linguistic field, the distinction into several levels is essential: the segmentations obtained in terms of syntax do not necessarily correspond to those obtained in terms of phonology or metrics. Cf., for illustrations, Claude Lévi-Strauss and Roman Jakobson, 'Les Chats de Charles Baudelaire', *L'homme: revue française d'anthropologie*, Vol. 2, No. 1, January-April 1962, pp.5-21; trans. Fernande M. De George in *The Structuralists: From Marx to Lévi-Strauss*, ed. Richard T. and Fernande M. De George (Garden City, N.Y.: Anchor Books, Doubleday, 1972), pp.124-46, and my article 'Sur un vers de Charles Baudelaire', *Linguistics*, Vol. 17, 1965, pp.69-77; reprinted in *Langage, musique, poésie*, Collection poétique (Paris: Seuil, 1972), pp.200-9. Finally, it is hardly necessary to observe that many linguistic elements may play a part in a musical analysis *in so far as they are musical elements*: thus rhyme can act as timbre or syllabic/melismatic opposition as staccato/legato opposition, etc.

19. This distinction is not absolute and a whole range of possibilities exists. Let us stress that the word *parametric* is used here in a slightly different way than in the writings of serial musicians. To designate what they understand by *parameters*, I shall speak simply of dimensions of the musical substance.
20. Cf. especially André Souris, 'Forme', *Encyclopédie de la musique*, 3 vols (Paris: Fasquelle, 1958-61), Vol. 2, pp.119-23.
21. Gilbert Rouget, 'Un chromatisme africain', *L'homme: revue française d'anthropologie*, Vol. 1, No. 3, September-December 1961, p.41.

22. With, possibly, new short remainders to transmit to a later stage of the analysis; for example,  $A + A + X = A + A + B + C + y$  (level I units are represented by upper case letters and those of level II by lower-case letters).
23. Cited after Reese, *Music in the Middle Ages*, p.239, who cites in turn Paul Runge, *Die Lieder und Melodien der Geissler des Jahr 1349 nach der Anzeichnung Hugo's von Reutlingen* (Leipzig: Breitkopf und Härtel, 1900), p.9. Since I am not interested here in problems of transcription, I take the transcriptions as data, without prejudging their validity.
24. Cf. Lévi-Strauss, *Anthropologie structurale*, pp.234-5.
25. Cf. Harris, *Methods in Structural Linguistics*, p.1: 'These procedures also do not constitute a necessary laboratory schedule in the sense that each should be completed before the next is entered upon. In practice, linguists take unnumbered short cuts and intuitive or heuristic guesses, and keep many problems about a particular language before them at the same time . . . . The chief usefulness of the procedures listed below is therefore as a reminder in the course of the original research, and as a form for checking or presenting the results . . . .'
26. To simplify, in the course of the analysis, I shall take account only of the first variation, since the second is well explained as a combinatorial variation as a result of the syllabic and metric structure of the words (two syllables, accented and unaccented respectively, against a single accented syllable); I thus derive only two level II units, b and b'.
27. This criterion, sufficient in this form for the piece in question, would need to be refined. It would be necessary at least to take account of the rhythmic structure (anacrusis, etc.).
28. From Friedrich Gennrich, ed., *Troubadours, Trouvères, Minne- und Meistergesang, Das Musikwerk 2* (Cologne: Arno Volk Verlag, 1951), p.25.
29. That this route is longer does not necessarily mean that it is less economical. It is not only more rigorous but it brings forth information which is absent in the other case: for example, it indicates that, from a certain point of view, everything which is enclosed within the two statements of B comprises a single unit.
30. This notation is borrowed from transformational linguists; cf., for example, Bach, *Transformational Grammars*. I disregard here the difference between a and a' and z and z'.
31. Gennrich, *Troubadours, Trouvères*, p.16.
32. In this table, as in the following one, certain segments are reproduced twice – once within parentheses – in the same row but in different columns. In this case, the two occurrences are equivalent to a single element and signify that this element could equally well appear in two units but that it has – more or less arbitrarily – been assigned to one.
33. Gennrich, *Troubadours, Trouvères*, p.13.
34. These, with the insistence on the a which they introduce, often have the effect of giving a suspensive aspect to this section, which contrasts it with the corresponding section in A.
35. Edmond Costère, 'Mélodie', *Encyclopédie de la musique*, 3 vols (Paris: Fasquelle, 1958-61), Vol. 3, pp.178-81.